Why High School Students Feel Mathematics Difficult? An Exploration of Affective Beliefs

K. Abdul GafoorAssociate Professor
Department of Education
University of Calicut

Abidha Kurukkan Research Scholar Department of Education University of Calicut

Paper presented

In

UGC Sponsored National Seminar on

Pedagogy of Teacher Education- Trends and Challenges

At

Farook Training College, Kozhikode, Kerala

On

18th and 19th August 2015

Why High School Students Feel Mathematics Difficult? An Exploration of Affective Beliefs

K. Abdul Gafoor & Abidha Kurukkan

Abstract

Mathematics is an indispensable subject of school curriculum and is important in daily living as well as in the study of other subjects. However, there is a common belief that majority of the students dislike mathematics, owing to an array of factors related to instruction and learners' cognitive, affective and psychomotor attributes, subject matter and the learning environment. This paper elaborates on the affective factors influencing learning of school mathematics as perceived by the learners. A questionnaire survey was conducted on a random sample of 51 standard IX students to obtain data on their mathematics related expectancies, task value beliefs, self-efficacy beliefs, epistemological beliefs, goal orientation, interest and anxiety. Among these students, 88% selected mathematics as the subject hated by them and only 6% report they like mathematics. Major reasons to dislike mathematics were related to difficulty in understanding the subject matter, and teacher or instructional related factors. When 20% rated mathematics as a very difficult subject, 54% reported medium difficulty, with only 10% considering it as an easy subject. Around 42% fail to identify the ways to solve problems provided in their textbook. A large division of students use blind strategies in learning mathematics and possess less adaptive self efficacy beliefs and epistemological beliefs.Implications are added.

Key words: Difficulties in mathematics, mathematics teaching, mathematics learning, affective factors.

Introduction

Mathematics is a unique subject and it is a fundamental part of school curriculum. It is an instrument for the development of all other sciences. Knowingly or unknowingly, we are using mathematics in every facets of life. However, majority of students across the world dislike mathematics. Scarpello (2007) reports that seventy-five percent of Americans stop the study of mathematics and stay away from many careers that related to mathematics. He identifies mathematics anxiety as one of the main reason for this.

Learningis influenced by many factors, which can be cognitive or affective. Here, we are concentrating on affective side. Hart (1989) defined attitude towards mathematics as a complex of negative or positive emotions that associated with mathematics, individual beliefs towards mathematics and their behaviour associated with mathematics.

Beliefs are one of the main areas of affective research since 1990s. Beliefs can be defined as implicitly or explicitly held subjective conceptions students hold to be true, that influence their learning (Op'tEynde, De Corte &Verschaffel, 2002). Expectancy value, task value, self efficacy, epistemological beliefs and goal orientations got special attention as the most influential beliefs that influence mathematics outcomes.

Self-efficacy is a person's perception about his ability to reach the goal (Bandura, 1977). Self-efficacy does not represent one's ability, but his beliefs; it affects achievement through the selection of task and effort. Expectancies for success is defined as one's beliefs about the success of his or her performance on an upcoming task (Eccles et al, 1983). Expectancy value theory proposes that when a number of electives are available, one will choose a task with more success expectation and value. Task value beliefs are "beliefs about the importance of, interest in, and value of the task" (Pintrich, 1999). Epistemological beliefs are beliefs hold by students about the nature of knowledge and its acquisition. Epistemic beliefs of students are known to influence the types of achievement goals, learning strategies and achievement of them (Muis, 2008; Muis& Franco, 2009; Trautwein& Ludtke, 2007).

Need and significance of the study

Mathematics is a subject that causes many negative emotions. One of the main challenges to mathematics teacher is to make a positive attitude in students toward learning mathematics. Therefore, teachers should be aware of students' affective beliefs and inter relations of those in learning mathematics so as to employ more effective strategies in teaching and to improve students' mathematics learning by reducing their negative beliefs.

This study aims to identify the difficulties felt by students in learning mathematics, students' affective reasons for disliking mathematics and to know how their motivational beliefs relate to their liking of subject and expectancy about its difficulty.

Methodology

Participants

Participants were 51 ninth standard students (25 boys and 26 girls) from Malappuram district; only students who were willing to attend the survey are included in the study.

Instrument

Difficulties in learning mathematics questionnaire is administered to obtain data on students' likes and dislikes, motivational beliefs, learning strategies and their perceptions regarding difficulties in learning mathematics. This questionnaire includes open ended as well as scaled items.

Procedure

After creating rapport with students, and giving reassurance on anonymity and ensuring their willingness to provide the data approximately fifty minutes were allowed for completing the questionnaire with factual clarification from the administrator wherever required.

Data Analysis

Percentage analysis and χ^2 test of independence were used to test the association, if any, between students felt difficulties and their motivational beliefs in mathematics.

Result

Mathematics is most liked subject for only 3(6%) students and it is the hated one for 45 (88%) students. Their main reasons for hating mathematics were difficulty in understanding the subject, poor instruction and demand of more time to grasp, but even after which they easily forget what is learnt. Among the 51 students, 82% of students reported that they do not like mathematics, and among these students 75% has a belief that mathematics is a difficult subject. When 20% rated mathematics as a very difficult subject, 54% reported medium difficulty, and only 10% considerit as an easy subject. Around 42% fail to identify the ways

to solve problems provided in their textbook. Even as 63% find it as boring and58% of students fear mathematics, still, 43% felt learning mathematics as interesting. Despite this, 82% of students are willing to learn mathematics. A large division of students use blind strategies in learning mathematics and possess less adaptive self-efficacy beliefs and epistemological beliefs but majority of students are accepting the utility value of mathematics. Higher proportion of students (65%) found algebra as difficult rather than geometry (12%).

Liking mathematics affects student interest, boredom, self-efficacy beliefs and task value beliefs related to mathematics. Significant more number of students who feel mathematics as difficult tends to dislike mathematics (93%) than those who feel mathematics as easy (59%) [χ^2 (1, N=51) =9.37, p<.01]. Also, significant more number of students who like mathematics tends to find interest in mathematics (77%) than those who dislike mathematics (36%) [χ^2 (1, N=51) =5.08, p<.05]. However, significant more number of students who dislike mathematics has a feeling of boredom in mathematics (73%) than students who like mathematics (11%) [χ^2 (1, N=51) =12.06, p<.01]. Students' likes towards mathematics in turn is significantly dependent on their self-efficacy in mathematics. That is, students who like mathematicstends to have positive self-efficacy(89%) and those who dislike it tends to have negative self-efficacy (53%) for learning mathematics [χ^2 (2, N=51) =5.37, p<.05]. And, students who dislike mathematics tends to hold significantly low task value belief than those who like mathematics [χ^2 (2, N=51) =13.49, p<.01].

Feeling mathematics as difficult for students affects not only their liking of mathematics but also their perseverance, interest, boredom and self-efficacy beliefs related to mathematics. Whereas feeling of mathematics as a difficult subject is significantly associated with low perseverance [$\chi^2(3, N=51)$ =9.78, p<.05]. Predictably, students who feel mathematics as difficult tends to have low interest in learning mathematics (76%) significantly more than those who feel mathematics as easy (17%) [$\chi^2(1, N=51)$ =15.99, p<.01] and students who feel mathematics as difficult tends to feel boredom in mathematics (79%) significantly more than those who feel mathematics as easy (29%) [$\chi^2(1, N=51)$ =12.12, p<.01]. Students' self-efficacy belief is significantly dependent on their feeling of difficulty in mathematics, that is students who feel mathematics as difficult tends to have negative self-efficacy(65%) and those who felt easy tends to have positive self-efficacy (94%)for learning mathematics[$\chi^2(2, N=51)$ =17, p<.01]. Despite these, students who feel mathematics as a difficult subject tends to hold significantly low task value belief than those who feel mathematics as easy [$\chi^2(2, N=51)$ =7.10, p<.05].

Discussion

Mathematics is considered a difficult subject by most of the students due to aversive teaching style, difficulty in following the instruction, difficulty in understanding the subject, and difficulty in remembering its equations and ways to solve problem. The same reason is given by students for disliking mathematics and there is a strong association between their belief regarding the difficulty of subject and dislike towards math. That implies, students

dislike mathematics as they perceive it as a difficult subject. Also, the association of these two with 'I can/can't do math' (self-efficacy) is significant. Perception of math as a difficult subject is associated strongly to lower self-efficacy than disliking of the subject. This finding supports very much the findings of Zan and Martino (2008) that students like mathematics as they can do it and dislike it as they can't do it.

Liking of mathematics is associated with more positive affects like interest, positive expectations, higher self efficacy and personal values towards math, whereas dislike is associated with boredom, low self efficacy, fear and negative expectancies.

Mathematics has some inherent difficulties due to its abstract and cumulative nature. So students requires a firm foundation, they may not be able to learn new things without previous knowledge. For many students expectancy about the difficulty of math is high, and personal value attached with math is low. In the case of these students, the chance for developing an avoiding or escaping tendency will be high. More number of students perceives algebra as difficult area in comparison to geometry; may be due to its abstract nature and use of variables and may be because, in the case of geometry, more daily life examples are possible.

Half of the students hold positive self-efficacy belief and other half have negative self-efficacy. Self-efficacy affects students' motivation, persistence and achievement (Zimmerman, Bandura & Martinez-Pons, 1992; Liu &Koirala, 2009). Almost all studies on self-efficacy and achievement propose that self-efficacy is an essential motive to learn. As the students lack self-efficacy to learn mathematics their effort also will be low.

Students are accepting the utility value of mathematics, but they haven't any personal value attached with mathematics. So, though they do not like mathematics they may choose to study because of its practical value. But when a task is difficult to them chance for avoiding that task will be higher. One of the positive beliefs students hold that they can do better if they try hard; they are accepting the value of effort.

Thus, reciprocal relationships exist between every attitudinal measure and mathematics achievement, and the feeling of enjoyment directly affects mathematics achievement (Ma, 1997); we call for teachers' attention on affect of their students learning. Perceived difficulties, lack of self-efficacy, dislike, boredom, negative beliefs and lack of task value causes for low participation by students in mathematics (Brown, Brown &Bibby, 2008). Teachers need to use effective ways to motivate students to learn mathematics regardless of student difficulties. Teachers can contribute to improve students' liking of the subject by improving students' affective beliefs.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, 84, 191-215.

Brown, M., Brown, P., & Bibby, T. (2008). "I would rather die": Reasons given by 16-year-olds for not continuing their study of mathematics. *Research in Mathematics Education*, 10(1), 3-18.

Di Martino, P., &Zan, R. (2011). Attitude towards mathematics: a bridge between beliefs and emotions. *ZDM*, 43(4), 471-482.

- Eccles J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75–146). San Francisco, CA: W. H. Freeman.
- Hannula, M. S. (2002). Attitude towards mathematics: Emotions, expectations and values. *Educational studies in Mathematics*, 49(1), 25-46.
- Hart, L. (1989). Describing the Affective Domain: Saying What We Mean.In Mc Leod& Adams (Eds.) Affect and Mathematical Problem Solving (pp.37-45). New York: Springer Verlag.
- Liu, X., &Koirala, H. (2009). The effect of Mathematics Self-Efficacy on Mathematics Achievement of High School students Northeasten. In *Educational Research Association (NERA) Annual. Conference Preceding*.
- Ma, X. (1997). Reciprocal relationships between attitude toward mathematics and achievement in mathematics. *The Journal of Educational Research*, 90(4), 221-229.
- Mata, M. D. L., Monteiro, V., & Peixoto, F. (2012). Attitudes towards mathematics: Effects of individual, motivational, and social support factors. *Child development research*, 2012.
- Muis, K. R. (2008). Epistemic profiles and self-regulated learning: Examining relations in the context of mathematics problem solving. *Contemporary Educational Psychology*, *33*(2), 177-208.
- Muis, K. R., & Franco, G. M. (2009). Epistemic beliefs: Setting the standards for self-regulated learning. *Contemporary Educational Psychology*, *34*(4), 306-318.
- Op'tEynde, P., De Corte, E., & Verschaffel, L. (2002). Framing students' mathematics-related beliefs. In *Beliefs: A hidden variable in mathematics education?* (pp. 13-37). Springer Netherlands.
- Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of educational research*, *31*(6), 459-470.
- Scarpello, G. (2007). Helping Students Get Past Math Anxiety. *Techniques: Connecting Education and Careers (J1)*, 82(6), 34-35.
- Trautwein, U., &Ludtke, O. (2007). Epistemological beliefs, school achievement, and college major: A large-scale longitudinal study on the impact of certainty beliefs. *Contemporary Educational Psychology*, 32(3), 348-366.
- Zan, R., &Martino,P. (2008). Attitude toward mathematics: overcoming the positive/negative dichotomy," in Beliefs and Mathematics, B. Sriraman, Ed., The Montana Mathematics Enthusiast: Monograph Series in Mathematics Education, pp. 197–214, Age Publishing & The Montana Council of Teachers of Mathematics, Charlotte, NC, USA, 2008.
- Zimmerman, B. J., Bandura, A., & Martinez-Pons. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal-setting. American Educational Research Journal, 29(3), 663-676.